

Remarks

In view of the above amendments and the following remarks, reconsideration and further examination are respectfully requested. Claims 1-26 and 31-35 are pending and stand rejected. Claims 1, 8, 16, 21, 31 and 34 have been amended.

Claim Amendments

The pending independent method claims have all been amended to recite use of computer, which is seen to obviate any potential 101 rejections due to the recently decided Bilski case. Claims 1, 8, 31 and 34 have also been amended to improve readability and to facilitate understanding. No modification of claim scope is contemplated nor is any new matter intended to be added. Claims

In particular, as to claims 8 and 31, the addition of the identifier "first" to "group of data vectors" is intended to emphasize that the *first group* of data vectors correspond to the *first portion* of the data stream. Likewise, the addition of the identifier "first" to "set of values" in claims 1 and 34 is intended to emphasize that the *first set* of values are determined in connection with the *first group* of data vectors.

The amendment to the first clause of claim 1 (last clause of claim 34) is intended to make explicit that the first and second groups of data vectors are different, i.e. that they correspond to different portions of the stream of data vectors. This has been implicit in the logical structure of claims 1 and 34 (e.g. because they already specify the projecting of the second group in terms of the visualization and set of values generated from the first group). By making this limitation explicit, Applicant intends to facilitate understanding of these claims.

Claim Rejections

Independent claims 1 and 34

Claims 1 and 34 stand rejected as anticipated by Hutson. These rejections are traversed. Due to the similarity of these claims, only the rejection of claim 1 need be explicitly addressed. Equivalent arguments apply to claim 34.

Claim 1 involves processing two different groups of data vectors corresponding to different portions of a stream of data vectors. "Generating a visualization" and "determining a

first set of values" involves the *first group* vectors, and the first set of values must correspond to eigenvectors(s) for the *first group* vectors (i.e. eigenvector(s) "for a matrix defined with the first group of the data vectors"). The *second group* vectors are then projected onto the visualization as a function of those *first group* values/eigenvectors(s). Accordingly, claim 1 requires that a second set of vectors be projected onto a visualization as a function of eigenvector(s), wherein both the visualization and the eigenvector(s) have been determined from a *different* set of vectors (i.e. the first group vectors). At least because Hutson fails to teach the projection of one set of vectors onto a visualization as a function of eigenvector(s) determined from a *different* set of vectors, Hutson does not anticipate the claim.

Hutson describes an algorithm that is carried out in full each time new data is received. (FIG. 13, col.8 lines 8-35) With reference to column 8, lines 8-35 and FIG. 13, each time BRT scan data from a new time interval is received, this new data is added to a three dimensional matrix (132) and data from the oldest time interval is removed from the matrix (134). This updated matrix then undergoes a preprocessing function 136, which weights and reformats the data into a two-dimensional matrix. The reformatted data is then sent to a detection function 138, and it is during this detection function 138 where the singular value decomposition (SVD) noted in the Action occurs. (col. 10, lines 40-57; col. 9, lines 50-53 "right singular vectors, which are derived through singular value decomposition in the detection function.") After the detection function processing (138), the data is sent to an enhancement and tracking function 140 where it is filtered, enhanced, and arranged back into the form of a three-dimensional enhanced matrix. It is this three-dimensional enhanced matrix which is finally sent to the display function 142.

In other words, when new scan data is received, Hutson's entire process repeats, beginning with the addition and removal of data so as to form a new data matrix which includes the newly arrived data. (FIG. 13, col 8, lines 8-35) It is this new data matrix that is subjected to the preprocessing 136, detection 138 and enhancement/tracking functions 140 before being sent to the display function 142. Because the singular value decomposition is part of the detection function 138, new singular values and new singular vectors are necessarily being calculated each time new data is received. Thus, Hutson is processing a particular data set with singular values and singular vectors determined from that same data set. Hutson is not projecting the newly

arrived scan data onto his display as a function of the existing singular values (i.e. those calculated from the earlier data sets before arrival of the new data).

In maintaining the rejection of claim 1, the Action relies on portions of Hutson that are generalized descriptions of "using" singular vectors to process and enhance data, wherein the data is eventually displayed. However, the way Hutson is calculating and using his singular vectors is not what is recited in claims 1 or 34. Recalculating singular vectors with each data update, as described in Hutson, is computationally expensive. Applicant's method employs existing values/eigenvector(s) and projects second group vectors onto the visualization as a function of those existing values/eigenvector(s), which allows for rapid updating without significant computational expense.

Rejected dependent claims

Hutson does not employ multidimensional scaling to generate a scatterplot

Claim 4 further specifies performing a multidimensional scaling routine with the first group of vectors to generate the visualization in the form of a scatter plot. The Action relies on Hutson's description of using singular values "to enhance" the input data as representing the application of multidimensional scaling to create a visualization in the form of a scatterplot as claimed. For a number of reasons, Applicant respectfully disagrees.

Hutson does not use the term multidimensional scaling to describe any portion of his algorithm, and one of skill in the art would not consider Hutson's SVD to be multidimensional scaling as claimed. Rather, as is known in the art, multidimensional scaling (MSD) serves to generate low-dimensional configurations of high dimensional data such that similarities between the high dimensional data are represented in the low-dimensional space. (See Specification, paras. 45-46) For example, given a dataset represented by high dimensional vectors, a conventional MDS routine would produce a 2-D scatter plot wherein the pairwise distances between points in the scatterplot approximate the similarities between the vectors that represent the points. (See Specification para. 45-46) By contrast, the fundamental objective of Hutson is to display data "in a true space-time format" (col. 14, lines 36-39), and Hutson employs SVD explicitly to decompose the data into its temporal and bearing components. (col. 5, lines 46-48) Therefore, rather than being intended to represent similarities in multidimensional space, Hutson's scatter plots are efforts to represent three (or four) dimensional sonar data in its

corresponding three (or four) dimensional space (c.g. time-bearing-frequency plots, FIGS. 9 and 10; addition of D/E angle for fourth dimension, col. 15, line 27)

For disclosure of projecting in response to an increase in data receipt rate (claim 5), the Action points to the three different data update rates referenced in column 15 lines 36-48 of Hutson. However, those data update rates appear to relate to the sonar monitoring system (i.e. being based on inherent characteristics of a two dimensional spherical sonar array that produces the four-dimensional sonar data (col. 15, line 35)). Hutson's data processing system receives its data from the sonar monitoring system (col. 5, lines 9-11), but Hutson's data processing system is neither monitoring nor adapting to changes in data receipt rates from the sonar monitoring system. Rather, it appears that each data slice sent to the data processing system, regardless of how that slice is being updated or obtained by the sonar monitoring system, is individually input to the processing function. (col. 15, line 48)

To the extent the cited section (column 15 lines 36-48) of Hutson is contemplating bypassing the data processing system altogether, for example so as to directly add some of the newly collected bearing/amplitude data to the operator's bearing/amplitude display, the rejection is still improper. The Action is asserting that projecting as a function of singular vectors (as per claim 1) occurs in Hutson's data processing system. Claim 5 requires that the projecting be performed, not bypassed, in response to an increase in the rate of receipt.

Independent claims 8 and 31

Claims 8 and 31 each recite updating a visualization with *additional/other* data vectors as a function of an eigenspace defined with a *first group* of data vectors. As explained above, Hutson does a full recalculation of singular vectors for each data update (i.e. for each cycle of the data processing algorithm, FIG. 13). For at least this reason, Hutson does not calculate an eigenspace for one set of data and then use that existing eigenspace when additional/other vectors arrive.

Furthermore, as explained above with respect to claim 5, Hutson's data processing system is not itself responsive to changes in the data receipt rate, as is explicitly required in claim 31. While the sonar monitoring system may collect data at different rates and/or have some data bypass the data processing system, nothing in Hutson suggests how the overall algorithm (illustrated in FIG. 13) would change or otherwise respond to changes in the data receipt rate.

As to claim 8, the Action asserts the combination of Schklnik into Hutson. Schklnik's data concentrator converts plural low speed data streams into a single high speed data stream, which, if added to Hutson, would seem to provide Hutson's data processing system a single, high speed data stream. However, claim 8 specifically requires processing of high data rate vector(s) (additional vectors) based on eigenvectors determined from low data rate vectors (first group vectors). The asserted combination is seen to merge data streams without distinguishing between the high data rate and low data rate vectors, which is counter to processing high data rate vectors based on low data rate vectors as recited in claim 8.

Independent claims 16 and 35

In rejecting claims 16 and 35, the Action asserts that it would have been obvious "to replace Hutson's decomposition with Harr wavelet decomposition" as taught by Chakrabarti. (OA page 12) Applicant disagrees because singular value decomposition (SVD) is essential to the proper function of Hutson's system, and substituting wavelet decomposition for Hutson's SVD would fundamentally alter the principal of operation of Hutson and/or render the Hutson algorithm unsuitable for its intended purpose.

Hutson describes a complete algorithm for handling sonar data, and Hutson's algorithm is based on SVD. A fundamental purpose behind choosing SVD is to decompose sonar data into its temporal and bearing components (col. 5, lines 46-48) for subsequent processing, but the use of SVD provides a number of other important benefits to Hutson's system. For example, beginning at col. 7, line 64 Hutson explains as follows:

"The system of the present invention implements an algorithm based on singular value decomposition, to aid in detecting and tracking objects. Correlating across time and frequency identifies those frequency bands containing similar track histories. This association enables an operator to detect and isolate acoustic sources, to suppress loud sources and noise, and to enhance other, quieter sources. This selective "partitioning" of sources on the basis of the magnitude of their singular values, or correlation, across frequency bands is important for detection of weak sources in the presence of loud interference and noise." (emphasis)

Because SVD is the cornerstone of Hutson's algorithm, Hutson teaches away from replacing SVD with something else.

The general disclosure of Chakrabarti regarding the benefit of using wavelet decomposition in analyzing text documents cannot overcome the specific teaching away inherent in Hutson. Moreover, Chakrabarti uses wavelet decomposition for analyzing text documents because it has "excellent energy compaction and *de-correlation* properties." (col. 4, lines 2-5, emphasis added) As noted above, Hutson is concerned with *enhancing correlations* across frequency bands in sonar data, and Hutson explicitly touts the ability of his SVD based processing algorithm to detect weak sonar sources in the presence of loud interference and noise. Accordingly, neither Chakrabarti nor Hutson alone or in combination are seen to provide any proper reason for replacing Hutson's SVD with wavelet decomposition.

Independent claim 21

Independent claim 21 recites the execution of a multi-dimensional scaling (MDS) routine and the performance of at least one of vector sampling and vector dimension reduction. As explained above with respect to claim 4, the SVD analysis in Hutson is not a multi-dimensional scaling routine. Hutson is not concerned with visualizing similarities in high dimensional data. Hutson is dealing with three or four dimensional sonar data, and his fundamental objective is to present that sonar data "in a true space-time format." (col. 14, line 39).

Furthermore, even if Hutson did teach MDS, it does not teach the combination of MDS and vector sampling or vector dimension reduction. The cited sections of Hutson describe singular value decomposition as a method for data compression and do not describe the further addition of vector dimension reduction (e.g. wavelet decomposition) or the process of selecting a subset of the data stream for evaluation and processing. Rather, the remaining sections of Hutson describe the conversion of a three-dimensional matrix into a two-dimensional matrix and vice versa. However, these processes only reduce the dimension of the three-dimensional matrix; they do not actually reduce the dimensions of the vectors contained therein. As such, for at least the reasons cited above, the rejection of claim 21 should be withdrawn.

With respect to dependent claim 26, Hutson fails to show updating the projection with one or more data vectors as required in order to anticipate claim 26. The sections of Hutson cited in the Action (col. 6, lines 41-50) are directed to the utilization of singular vectors for purposes of data compression, noise removal, and desired data enhancement, wherein the data may subsequently be visualized (see col. 7 l. 64 – col. 8 l. 3). Hutson does not specify how the

BTR representation 70 of FIG. 6 would be updated with subsequently received data, and Hutson fails to teach that such updating occurs as a function of the singular vectors

Closing

It should be understood that the above remarks are not intended to provide an exhaustive basis for patentability or concede the basis for the rejections in the Office Action, but are simply provided to overcome the rejections made in the Office Action in the most expedient fashion.

In view of the above amendments and remarks, it is respectfully submitted that the present application is in condition for allowance and an early notice of allowance is earnestly solicited. If after reviewing this amendment the Examiner feels that any issues remain which must be resolved before the application can be passed to issue, the Examiner is invited to contact the undersigned representative by telephone to resolve such issues.

Respectfully submitted,

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